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A new genus and species of Syllidae (Polychaeta) from Australia dorsally brooding eggs by means of compound notochaetae, with comments on external brooding in the family

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Abstract.—In this paper the description of *Nooralia bulgannabooyanga,* a new genus and species of Syllidae (Polychaeta), is given. The new genus is characterized by having a very small proventriculus, an unarmed pharynx, short dorsal cirri, except those of chaetiger 1, long antennae, two long pairs of tentacular cirri, long dorsal cirri on chaetiger 1, palps mostly free, fused at bases, both compound chaetae and simple dorsal chaetae on parapodia, and by dorsal brooding by compound notochaetae similar in shape to neurochaetae. The systematic position of the new genus in the family Syllidae and its relationships with other genera of the family is uncertain but is considered close to the subfamily Exogoninae. Comments on the external brooding and systematic implications are also included.

Recently, the author began a series of monographs on the Syllidae Grube, 1850 from around Australia, studying large collections deposited in the Australian Museum; the first monograph will be devoted to the subfamily Exogoninae Langerhans, 1879. Two new genera with short bodies, similar to the genera currently considered as Exogoninae, but provided with very distinctive features, have been discovered. The description of one of these genera is currently in preparation and the other enigmatic genus is described herein.

Contributions to the knowledge of Australian Syllidae have been made by Haswell (1886, 1920a, 1920b), Augener (1913, 1927), Fauvel (1917), Monro (1931), Hartmann-Schröder (1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1989, 1990, 1991), Hutchings & Rainer (1979, 1980), Hutchings & Murray (1984), San Martín & López (1998), and, recently, Glasby (2000) and Glasby & Watson (2001).

Materials and Methods

The specimens described below are preserved in 70% ethanol, after fixation in formalin, except one paratype, which was prepared for scanning electron microscopy (SEM). Observations and measurements were made using interference contrast optics (Nomarsky). Drawings were made with a drawing tube. The specimens are deposited in the polychaete collection of the Australian Museum, Sydney (AM).

Family Syllidae Grube, 1850

Genus *Nooralia,* new genus

Diagnosis.—Body small, short, with about 30 chaetigers. Surface of body smooth. Prostomium with 4 eyes and 3 antennae. Palps only fused at bases. Two pairs of tentacular cirri. Antennae, tentacular cirri and dorsal cirri of chaetiger 1 long, cylindrical to fusiform; remaining dorsal cirri short, lanceolate. Parapodia each with solitary dorsal simple capillary chaeta and several compound chaetae with unidentate and bidentate short blades. Ventral simple chaetae apparently absent. Pharynx long, unarmed, with a crown of soft papillae on anterior rim. Proventriculus very small, disproportionally short and slender. Pygidium

with 2 large anal cirri. Females brood eggs dorsally, by means of compound notochaetae, similar in shape to neurochaetae.

Remarks.—The relationships of *Nooralia,* new genus, are difficult to determine because *Nooralia* has very distinctive features: minute, indistinct proventriculus; absence of a pharyngeal tooth, and dorsally brooding eggs by means of compound notochaetae. This brooding feature is unique among the Syllidae. *Nooralia* appears to be related to some members of the subfamily Exogoninae. The shape of the dorsal cirri, the smooth surface and the dorsal brooding of eggs, as well as the shape of the aciculae of the single known species, suggest a relationship between *Nooralia* and *Grubeosyllis* Verrill, 1900. However, *Grubeosyllis* has palps fused by means of a dorsal membrane and a large proventriculus with very distinct pharyngeal tooth. Furthermore, the simple and compound chaetae of *Nooralia* are very different from any other genera included in the subfamily Exogoninae while appearing most similar to those of the subfamily Autolytinae Langerhans, 1879. Thus, *Nooralia* appears unique among the Syllidae. The members of the subfamily Exogoninae are characterized by having short bodies with few segments (around 30), small, meiofaunal size, large palps, fused totally or at least on their basal half, pharyngeal tube straight, provided with a tooth, and short, unarticulated dorsal cirri, presence of ventral cirri, 1 or 2 pairs of tentacular cirri, and absence of dorsal segmental ciliary bands (Glasby 2000). A very important biological feature of this subfamily is that the females take care of the eggs, but two different methods are employed. In some cases, the females carry the eggs dorsally by means of simple, thin, capillary notochaetae, that penetrate into the capsules (Kuper & Westheide 1998); in other cases, the brood is attached ventrally, probably by means of glandular secretions (Pierantoni 1903). Recent discussion on methods of reproduction in the Syllidae are provided by Garwood (1991) and Franke (1999) and additional information is presented in Westheide (1974), Perkins (1981), San Martín (1984a, 1991), and Kudenov & Harris (1995). In the case of dorsal brooding, the embryos leave the body of the female when embryonic development is completed; however, in the case of ventral brooding, each embryo develops to a juvenile stage that only leaves the female when it is fully developed. In some cases, the embryonic development occurs inside the body until the juvenile is totally developed (viviparity; Pocklington & Hutchenson 1983, San Martín 1984a), but this case can be considered as a modification of the latter. Kuper & Westheide (1998) and Franke (1999) consider that the dorsal or ventral attachment position is species-specific, and both can be found within a genus; however, this is contrary to material which I have examined of the genera *Brania, Grubeosyllis, Parapionosyllis,* and *Exogone* from all around the world. All species of *Grubeosyllis* and the recently described genus *Cicese* (Díaz-Castañeda & San Martín, 2001) brood dorsally, whereas species of *Brania, Parapionosyllis,* and *Exogone* brood ventrally and develop juveniles. The dorsal brooding is associated with the development of capillary notochaetae to attach the eggs (or with compound notochaetae in *Nooralia*), and the ventral brooding is associated with the development of glands which produce adhesive secretions and these females always lack notochaetae. It is difficult to accept that such different methods of egg protection, with each implying strong morphological changes, can occur within a single genus. Furthermore, both kinds of brooding have been reported in other members of the subfamily Eusyllinae Malaquin, 1893 (Heacox & Schröder 1978, Hartmann-Schröder 1979, Augener 1913, and pers. obs). These facts suggest that the subfamily Exogoninae is not a monophyletic group.

The genus *Sphaerosyllis* Claparède, 1863, as currently accepted, has species that brood dorsally and others that brood ventrally, developing juveniles (Riser 1991).

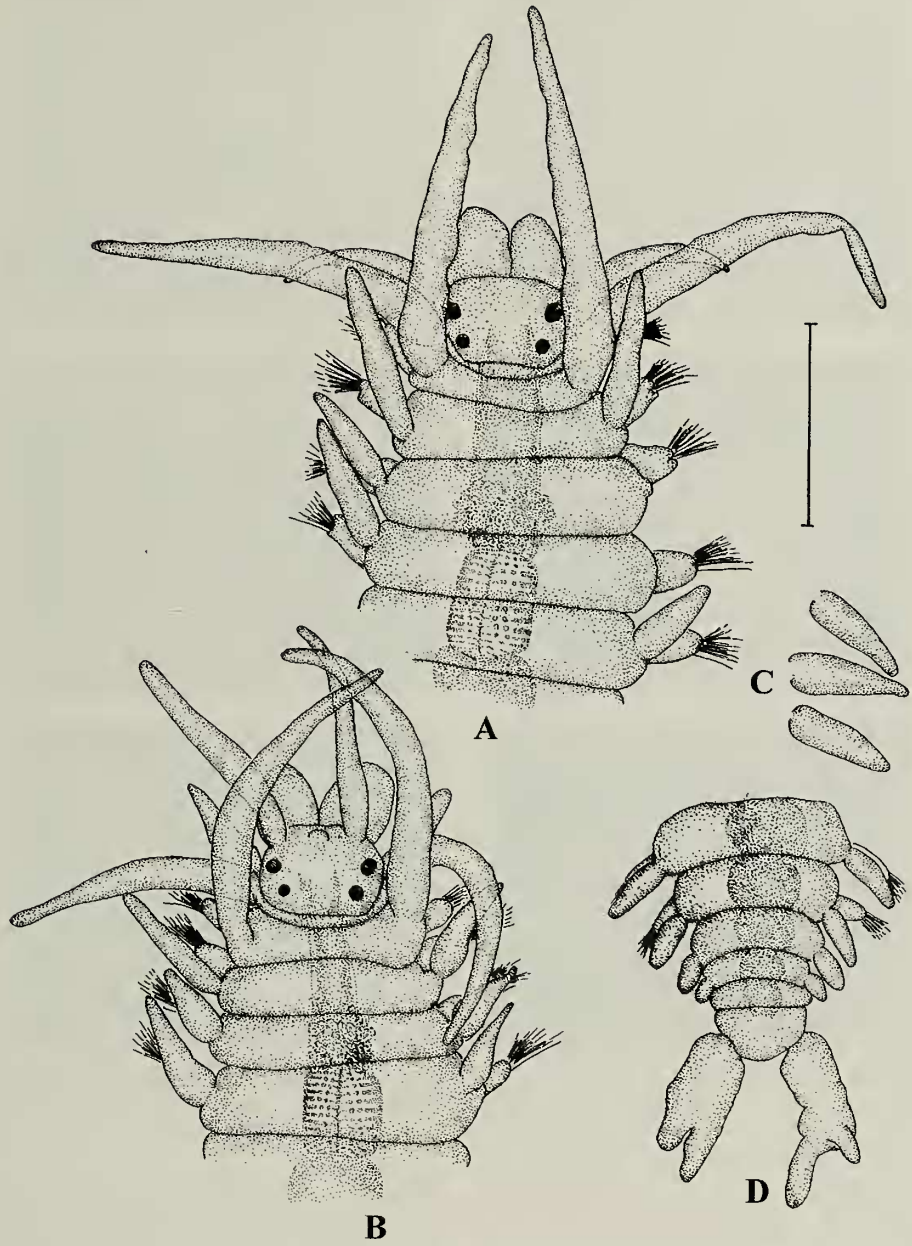

Fig. 1. *Nooralia bulgannabooyanga*. A, anterior end, dorsal view, holotype. B, anterior end, dorsal view, paratype. C, alternate dorsal cirri, midbody, holotype. D, posterior end, dorsal view, a paratype. Scale bar = 90 μm.

The species having small proventriculus, pharyngeal tooth conical, located on anterior rim of pharynx, and usually parapodial glands, brood ventrally and develop juveniles (included in the subgenus *Sphaerosyllis* by San Martín 1984b), and the species belonging to the subgenus *Prosphaerosyllis* San Martín, 1984, as well as the species of the "*erinaceus*" group, brood dorsally by means of notochaetae (pers. obs., Imajima 1966). This fact may also mean that *Sphaerosyllis* is not a monophyletic group.

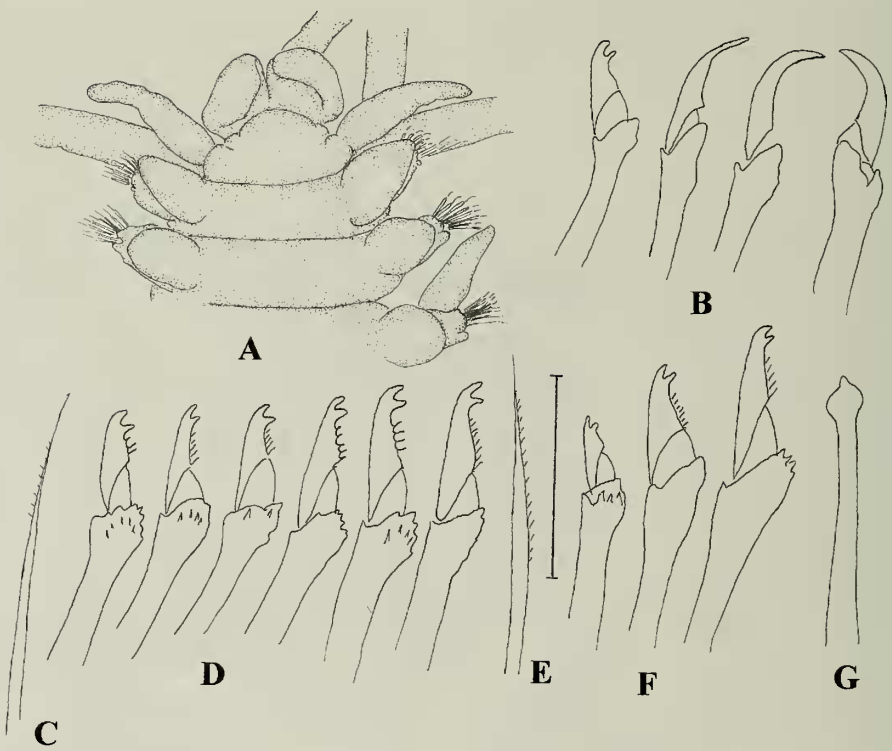

Fig. 2. *Nooralia bulgannabooyanga.* A, anterior end, ventral view, holotype. B, compound chaetae, chaetiger 1. C, dorsal simple chaeta, midbody. D, compound chaetae, midbody. E, dorsal simple chaeta, posterior parapodium. F, compound chaetae, posterior parapodium. G, aciculum. Scale bar: A = 90 μm; B–G = 28 μm.

Further investigations and a cladistic analysis of the subfamily Exogoninae and the relationships among all genera of this family is necessary to solve these systematic problems.

Etymology.—The name of the genus comes from an aboriginal word, "*Nooralie*" which means "imaginary beings" (Endacott 1973), and refers to the distinctive features of this genus.

Gender.—Feminine

Nooralia bulgannabooyanga, new species
Figs. 1–3

Material examined.—Barrenjoey Head, Broken Bay, New South Wales, 33°35′S 151°20′E, algae on rocky substrate, 5 m depth, 22 Apr 1993, AM W27399 (Holotype) and AM W27400 (2 Paratypes, one used for SEM study). Halway Reef, 200 m of Sullivan Reef, Ulladulla, New South Wales, 35°21.45′S 150°29.3′E, wall of sponges, bryozoa & hydrozoa, 15 m depth, 3 May 1997, AM W 26342 (1 Paratype).

Description.—Body small, short, without color markings, holotype 2.4 mm long, 0.3 mm wide, 31 chaetigers. Prostomium quadrangular to trapezoidal; 4 eyes in open trapezoidal arrangement, apparently without anterior eyespots (Fig. 1A, B). Antennae missing on holotype (Fig. 1A) and one paratype; another paratype (Fig. 1B) with lateral antenna but median antenna missing; lateral antennae originating just in front of anterior eyes, cylindrical, somewhat rugose, longer than joint length of prostomium and palps (Fig. 1B); probably median antenna inserted at same level as lateral antennae (scar shown in Fig. 1B). Palps fused on bases (Fig. 1A, B), usually ventrally folded (Fig. 2A). Dorsal tentacular cirri long and thick, tapered, laterally directed, similar to

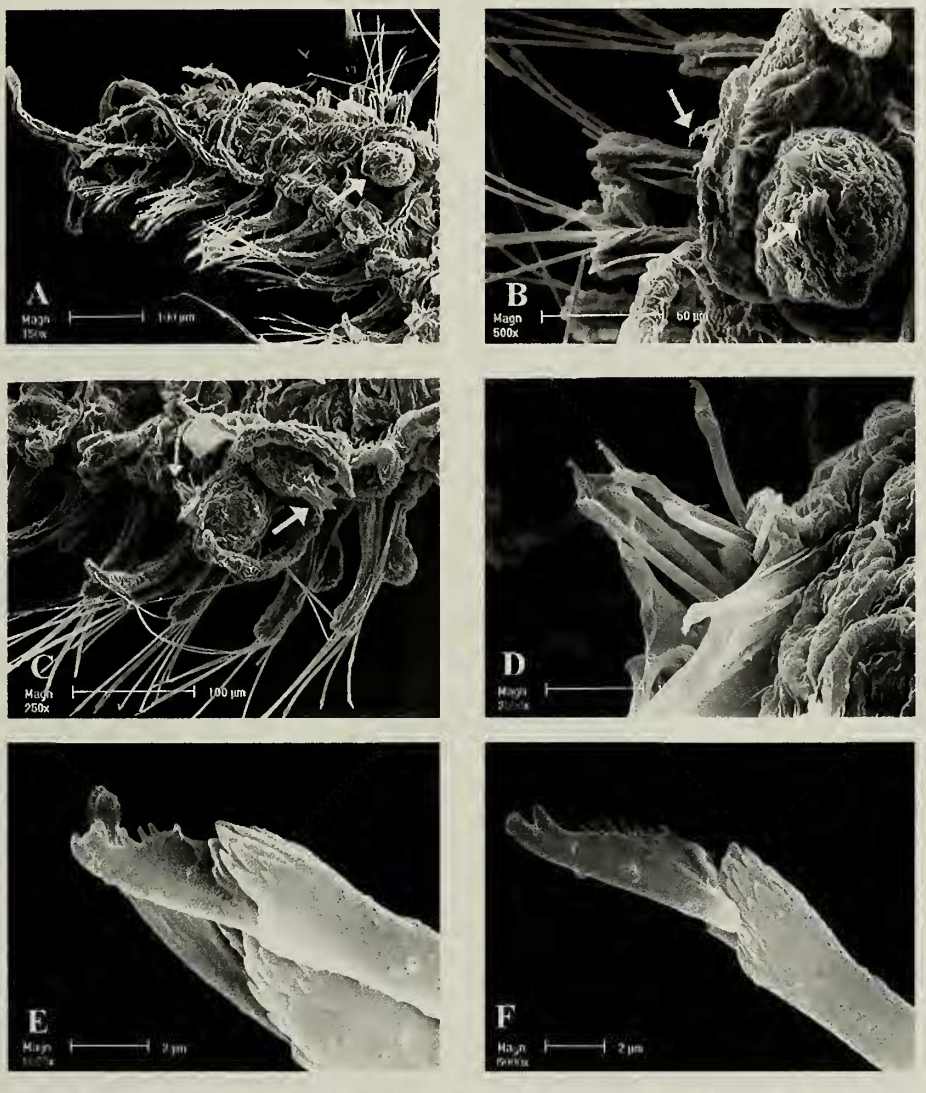

Fig. 3. SEM, paratype, female carrying dorsally attached eggs. A, anterior end, dorsal view; arrow indicates egg. B, detail of egg; arrows indicate notochaetae. C, same. D, detail of notochaetae. E, dorsalmost compound neurochaeta, midbody. F, ventralmost compound neurochaeta, midbody.

lateral antennae but longer, distinctly longer than body width (Fig. 1A, B); ventral tentacular cirri half length of dorsal tentacular cirri, oblique to laterally directed (Figs. 1A, B, 2A). Dorsal cirri of chaetiger 1 long, anteriorly directed, similar to dorsal tentacular cirri, slightly shorter (Fig. 1A, B). Dorsal cirri on all parapodia; dorsal cirri of chaetiger 2 much shorter than those of chaetiger 1, similar in length to ventral tentacular cirri, somewhat longer than remaining dorsal cirri (Fig. 1A, B); dorsal cirri of midbody lanceolate, length half of body width, longer than parapodial lobes, slight alternation in length (Fig. 1C). Last 2–3 segments with small dorsal cirri but lacking parapodia and chaetae (Fig. 1D). Ventral cirri large, ovate, somewhat laminar (Fig. 2A), those of chaetiger 1 somewhat larger than subsequent ones. Parapodial lobes conical, distally bilobed and provided with a posterior papilla (Fig. 2A). Parapodia of chaetiger 1 with one

compound bidentate chaeta, originating dorsally, and 6 compound chaetae with unidentate, smooth, curved blades (Fig. 2B); gradual increase in number of compound chaetae with bidentate blades per fascicle and corresponding decrease in chaetae with unidentate blades, which are absent from chaetiger 3–4. Midbody parapodia each with about 8–9 compound chaetae, strongly heterogomph, with spinose to rough shafts, and short, bidentate blades with short, fine spines on margin; dorsoventrally increasing in length (Fig. 3E, F), about 7–8 μm above, 10 μm below (Fig. 2D); posterior parapodia each with 9 compound chaetae, similar to those of midbody, with more pronounced differences between dorsal and ventral blades (Fig. 2F). Capillary dorsal simple, solitary chaetae from chaetiger 1, very thin, filiform on tip, distally with short, fine spines on margin, similar throughout (Fig. 2C, E). Ventral simple chaetae absent on these specimens. Aciculum solitary, slender, distally rounded, with a short tip (Fig. 2G). Pharynx long, slender, indistinct, everted or partially everted on all specimens (Figs. 1A, B, 3A), without pharyngeal tooth, a dark glandular area near proventriculus (Fig. 1A, B), a crown of 10 soft papillae on anterior rim and few other, very small and rounded, near distal crown. Proventriculus minute, difficult to see, through 1–2 segments (Fig. 1A, B). Pygidium semicircular, with 2 long and wide, bidfid anal cirri (only seen on 1 paratype; Fig. 1D). Females carrying eggs dorsally by means of compound notochaetae (Fig. 3A–C), similar in shape to neurochaetae (Fig. 3D) but smaller, penetrating into the capsules of eggs to hold them.

Distribution.—Only known from New South Wales (Australia).

Ecology.—Among algae, bryozoans and hydrozoans; 5–15 m depth.

Etymology.—The specific name is composed by the combination of two Australian aboriginal words, "*booyanga*" meaning "egg" and "*bulganna*" meaning "plenty" (Endacott 1973), and refers to the brooding of eggs by the females.

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